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Science and Technology for Tomorrow's Air and Space Force

Success Story

MUNITIONS DIRECTORATE HELPS DEVELOP A NEW HIGH-PERFORMANCE, LOW-COST STEEL

The patented Eglin Steel alloy, developed for hard target penetrator purposes, has far-reaching military potential applications, ranging from missile parts to tank bodies to any weapon system whose main structural components require high strength and toughness. The commercial implications are numerous as well, since the alloy's high strength and toughness characteristics can increase the overall endurance of machine parts, allowing for much greater periods between replacements than conventional materials.

Eglin Steel alloy is easy to weld, making it an attractive choice for a wide variety of built-up sections. The future looks bright for this high-performance, low-cost composition as a very viable candidate for the Guided Bomb Unit-28 pre-planned product improvement warhead case material.

Air Force Research Laboratory
Wright-Patterson AFB OH

Accomplishment

Using funding from the Dual Use Science and Technology program Dr. Morris F. Dilmore, from the Munitions Directorate, and Mr. James Ruhlman, consultant for Ellwood National Forge Company, developed and institutionalized a new high-performance, low-cost steel, named Eglin Steel, along with the associated melting, forging, and heat-treating processes required to deliver superior mechanical properties. This material has great potential for both military and commercial use and already exhibits increased depths of penetration and improved stability over conventional materials in scaled testing of hard-target penetrators.

Eglin Steel is outstanding not only because it exhibits superior strength and toughness (the ability of the material to absorb energy without fracturing) to that of conventional penetrator materials that are currently used for warhead cases, but also because its cost is equal to or less than that of these traditional, lower-performance casing materials. In today's environment, cost is an important factor for all military systems, and Eglin Steel will allow potential contractors to realize a reduction in their material cost estimates, while increasing the material performance necessary to ensure program success.

Background

Defeat of hard and deeply buried targets continues to be of great interest to the United States Air Force due to the ever-increasing challenge of destroying enemy assets housed either in tunnels or in deeply buried bunkers. In general, two avenues are available for destroying targets of these types: (1) an increase in the sectional pressure (weight per unit area) of a penetrator, and (2) an increase in penetrator impact velocity.

Increasing penetrator weight (cross-sectional pressure) is not an attractive choice, since the trend is toward smaller, more mobile weapon systems; therefore, an increase in impact velocity is the more desirable alternative. To survive high-velocity impact and destroy a hard or deeply burried target, the casing materials must exhibit excellent ultimate and yield tensile strengths, elongation, and toughness values.

About 4 years ago, the directorate, located at Eglin Air Force Base, Florida, initiated a program to develop a penetrator steel material having mechanical properties similar to current materials, with a corresponding cost reduction of up to 85%. Directorate engineers helped develop Eglin Steel with mechanical properties necessary to meet weapon performance requirements.

Munitions
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Additional information

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